

Ventilator Associated Pneumonia: Current State of Prevention

Daniel J. Diekema, MD, FACP

Professor and Director

Division of Infectious Diseases, Dept. of Internal Medicine


University of Iowa Carver College of Medicine

Associate Hospital Epidemiologist

University of Iowa Hospitals and Clinics

E-mail: daniel-diekema@uiowa.edu

Ventilator Associated Pneumonia: Risk Factors (partial list)

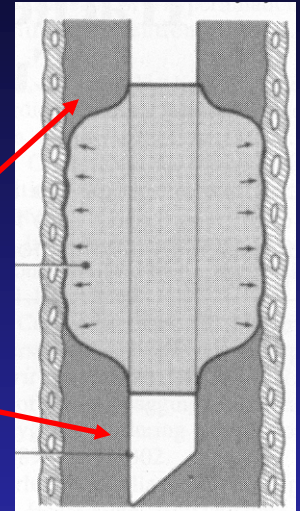
- *Mechanical ventilation*
 - Recumbent position
 - Increased gastric pH
 - Enteral feeding
 - ↓ level of consciousness
 - Advanced age
 - Male sex
 - Pre-existing pulmonary disease
- 
- aspiration

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm>

Niederman et al. Am J Res Crit Care Med 2005;171:388-416.

Pathogenesis of VAP

- Entry of pathogens into lower respiratory tract → colonization → infection
 - Leakage/aspiration around ET tube
 - Biofilm adherent to ET tube
- Inhalation of contaminated aerosols
- Direct inoculation
- Hematogenous spread
- Infection often multifocal



Niederman, Craven, et al. Am J Resp Crit Care Med 2005;171:388-416.

Preventing VAP:

↓ use of mechanical ventilation

- Facilitate/accelerate weaning
 - Protocols require adequate staffing
 - Reintubation also increases VAP risk
- Use non-invasive ventilation when possible
 - Positive pressure ventilation/facemask
 - COPD exacerbations, acute hypoxemic respiratory failure, immunocompromise with infiltrates and respiratory failure

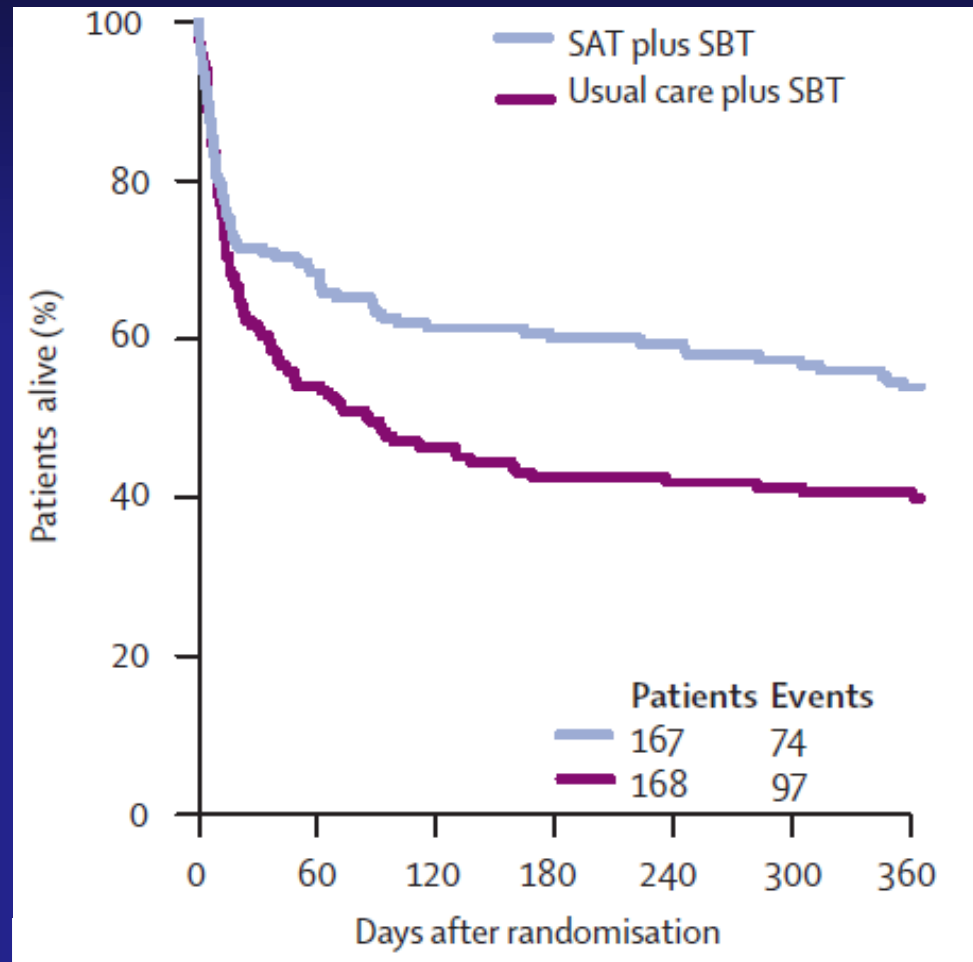
Reducing vent use: The “sedation vacation”

- Daily interruption of sedation:
 - 128 patients on mechanical ventilation randomized to daily interruption of sedation until awake
 - Duration of ventilation 4.9 vs. 7.3 days (p=0.004)

Kress JP et al. N Engl J Med 2000;342:1471-77.

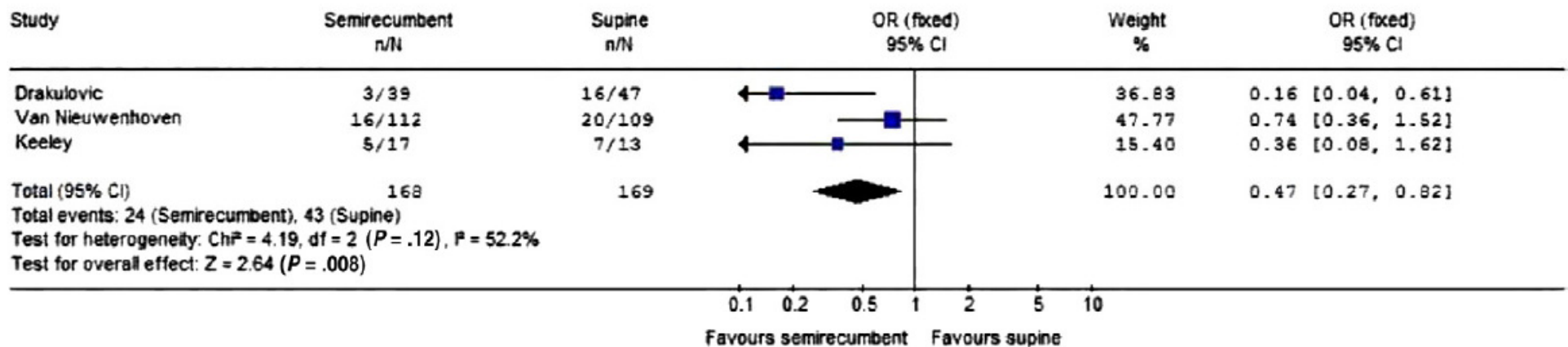
Spontaneous awakening trial + spontaneous breathing trial

- Intervention arm had fewer:
 - Vent days
 - ICU days
 - Hospital days
 - Deaths
- No difference in reintubation rates



Girard et al. Lancet 2008;371:126-34.

Reducing aspiration risk: Semi-recumbent positioning

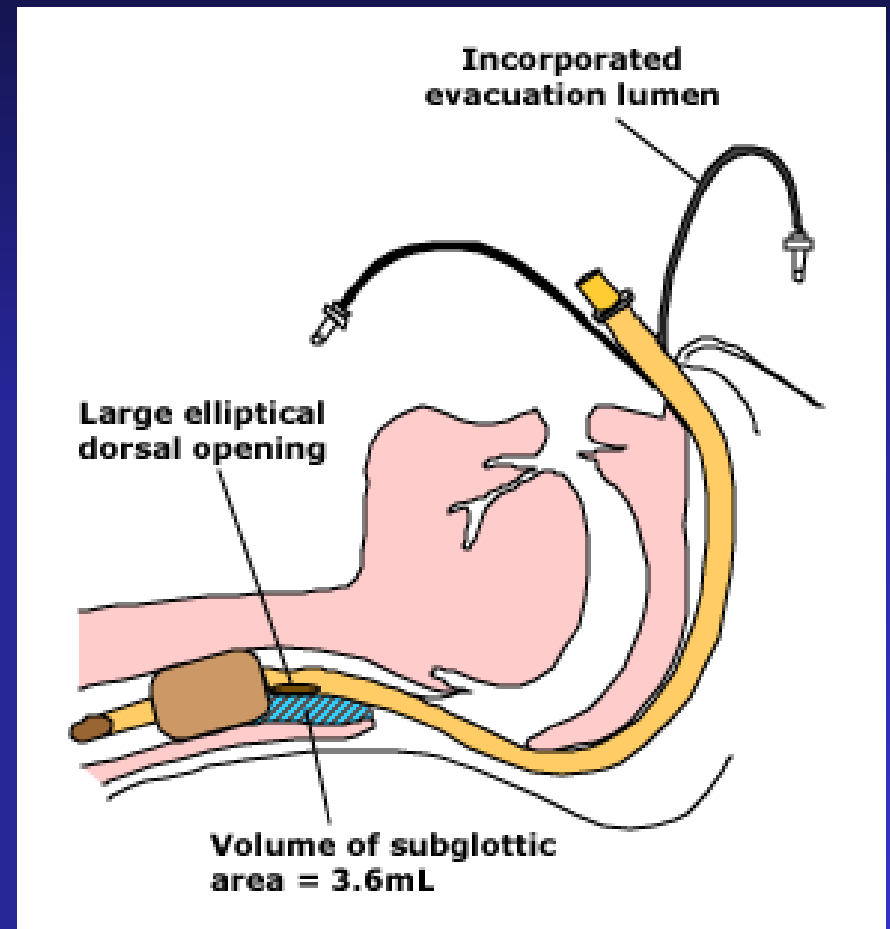


- One of three RCTs demonstrated significant ↓ in VAP
- Overall trend favors semirecumbent position
- Patients should not be completely supine.

Alexiou, et al. J Crit Care 2009;24:515-522

Reducing aspiration risk: Continuous subglottic suctioning

- Meta-analysis,
5 studies, 896 pts
 - VAP RR = 0.51;
95% CI 0.37-0.71
 - Greatest effect in
those intubated
>72 hrs

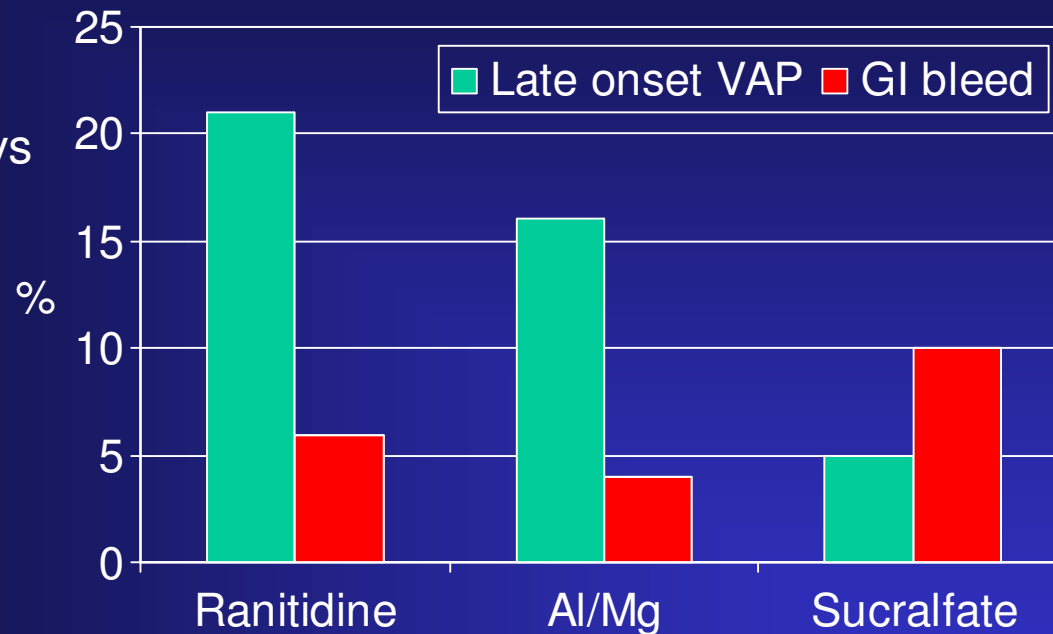


Dezfulian et al. Am J Med 2005;118:11-18

Preventing VAP: Choice of ulcer prophylaxis?

- Ranitidine vs. Al/MgOH vs. sucralfate

N = 244 randomized;
213 observed > 4 days



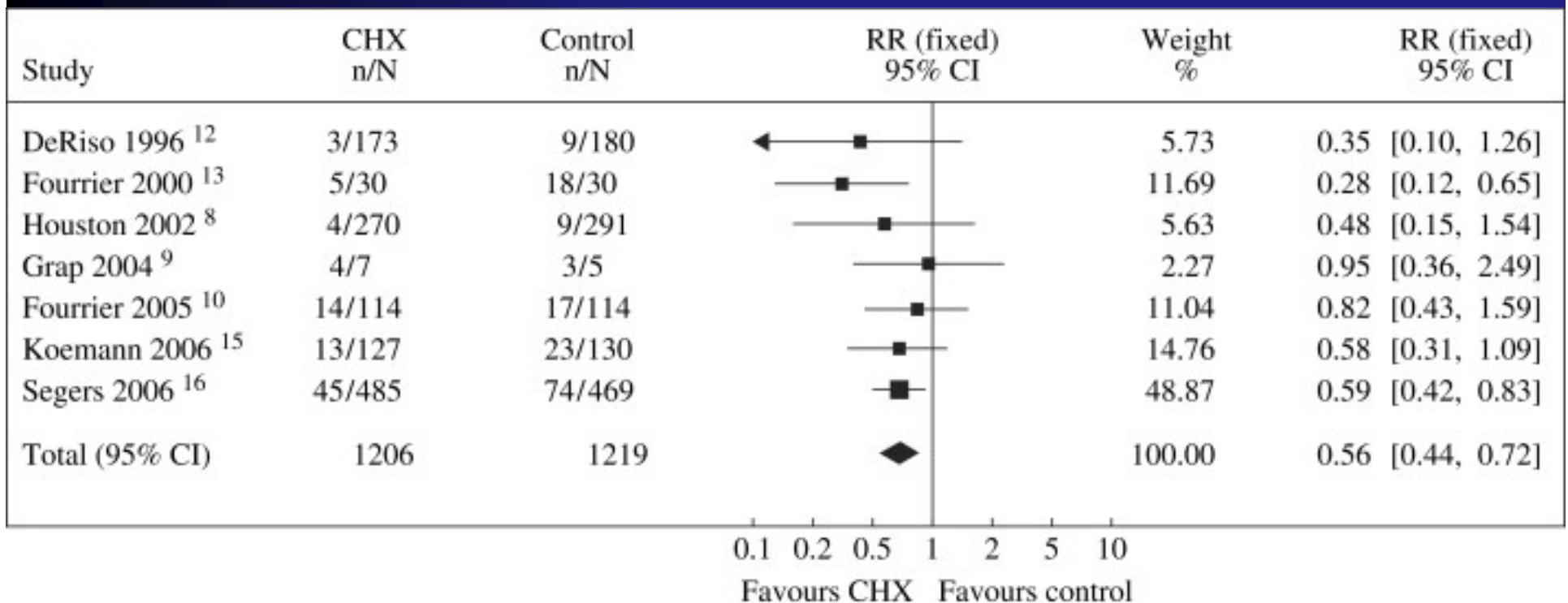
Larger, more recent studies demonstrate that H2 blockers or PPIs can more effectively prevent GI bleeding without increasing the VAP rate...

Prodhom et al. Ann Intern Med 1994;120:653.

Cook et al. N Engl J Med 1998;338:791-97.

Preventing VAP: Chlorhexidine oral care

- 2 meta-analyses published in 2007:
 - 11 RCTs → RR 0.56 [95% CI, 0.39-0.81]¹
 - 7 RCTs → RR 0.58 [95% CI, 0.44-0.72]²



(1) Chan et al. BMJ 2007;334:889. (2) Kola et al. J Hosp Infect 2007;66:207.

Preventing VAP:

Antibiotic Use: Selective DD +/- systemic

- Complex literature, variety of regimens used, definitions for outcome measure, etc.
 - 16 RCTs, 3361 patients¹
 - OR 0.35 [95% CI, 0.29-0.41] for VAP
 - OR 0.8 [95% CI, 0.69-0.93] for mortality
 - 54 RCTs, 9473 patients²
 - OR 0.11 [95% CI, 0.06-0.2] for Gram negative LRTI
 - OR 0.52 [95% CI, 0.34-0.78] for Gram positive LRTI

(1) D'Amico et al. BMJ 1998;316:1275.

(2) Silvestri et al. Anaesth Intensive Care 2008;36:324.

Digestive or Oropharyngeal Decontamination?

- Cluster randomized, crossover trial in 13 Dutch ICUs, S-DD v. S-OD v. standard care
- All regimens used over 6 months in each ICU
- S-DD: IV cefotaxime + tobra-colistin-ampho B
- S-OD: oropharyngeal application only (T-C-A)
- Only those with expected ICU stay > 72 hrs
- 5939 enrolled, 28 day mortality = 27.5%
- MLR model compared to standard care:
 - S-OD: OR 0.86 [0.74-0.99] for 28 d mortality
 - S-DD: OR 0.83 [0.72-0.97] for 28 d mortality

De Smet et al. N Engl J Med 2009;360:20.

S-DD for VAP Prevention

- Pro:

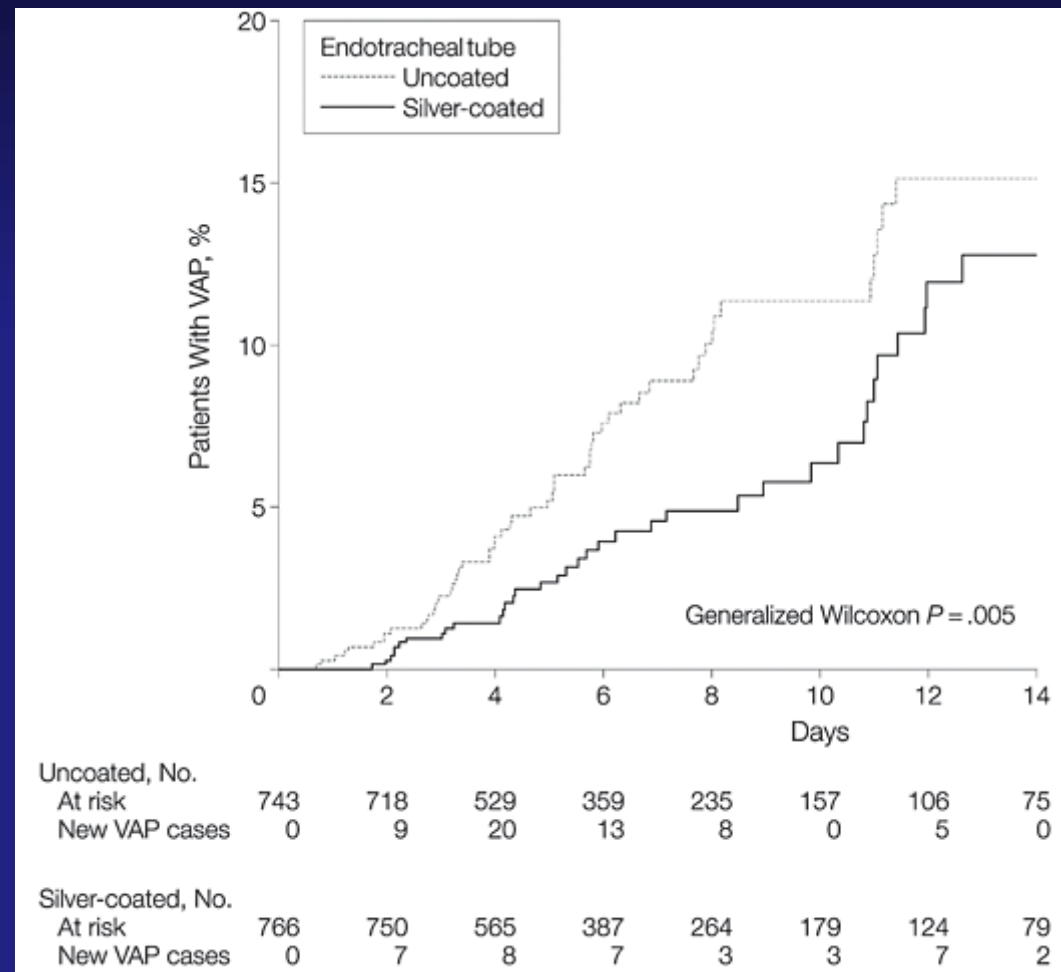
- Accumulated trials data support efficacy in reducing VAP and mortality

- Cons:

- Impact of systemic + oral antimicrobials on resistance emergence
 - Oostdijk, et al. Am J Resp Crit Care Med 2009;181:426.
- Can oral decontamination with chlorhexidine provide similar benefit?

Preventing VAP: Antimicrobial (silver) coated ET tubes

- 2003 pts randomized
- Among those intubated > 24 hrs:
 - 4.8 vs. 7.5% micro-confirmed VAP, $p=0.03$
 - No differences in intubation time, LOS, mortality



Kollef et al. JAMA 2008;300:805.

Multifactorial Interventions: The “ventilator bundle”

- Implementation of those interventions with the supporting evidence/feasibility
 - Hand Hygiene
 - Elevation of HOB
 - “Sedation vacation” each day
 - Assessment of readiness to wean
 - PUD and DVT prophylaxis
 - Chlorhexidine oral care (*new*)

The IHI Ventilator Bundle: Meta-analysis

- Only four studies met inclusion criteria
 - All had methodologic problems
 - All were “before-after” study designs
 - Little information re diagnostic approach before and after
 - Selection/publication bias, confounding?
 - **38-60% reduction in VAP post-intervention**
- *“Lack of methodologic rigor of the reported studies precludes any conclusive statements about the bundle’s effectiveness. The vent bundle is not a viable quality measure in the ICU....”*

Ventilator Associated Pneumonia: Summary

- VAP prevention literature is murky, but:
 - IHI bundle (including CHG oral care)
 - CSS if expect to be on vent >72 hrs
 - Or for all? Difficult to predict duration....
 - Other approaches (e.g. silver coated ET tubes, etc.) if rate remains elevated despite above approaches

Questions?